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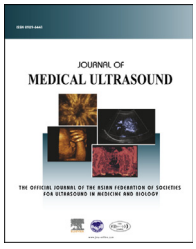

EDUCATION FORUM

The Use of Transient Elastography in Liver Disease

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Introduction

Transient elastography (TE; Fibroscan) is a noninvasive diagnostic tool designed by Echosens (Paris, France) to evaluate liver fibrosis. Its working principle is to place the probe on the liver surface, followed by generation of low frequency, low amplitude (50 Hz) vibrations transmitted by the vibrator in the probe, which introduces minor liver deformation, thus triggering an elastic shear wave that propagates through the liver tissue. In addition, pulse-echo ultrasound waves obtained by the transducer probe are used to analyze the velocity of the elastic shear wave within tissues, which can be used to measure liver stiffness using the equation $E(kPa) = 3\rho V^2$, where E is elastic modulus, ρ is mass density, and V is shear velocity (Fig. 1). In general, TE using the standard M probe measures a cylindrical volume approximately 1 cm in diameter and 4 cm in length, 25–65 mm underneath the skin surface. Moreover, the E is considered reliable when the following criteria are met: the success rate (number of valid acquisitions divided by the number of attempts) is over 60% and the ratio of the interquartile range to the median of 10 measurements should not be 30% greater than median.

Assessment of liver fibrosis severity

Invasive liver biopsy has traditionally been used to evaluate the severity of liver fibrosis caused by all kinds of hepatic diseases. However, liver biopsy can cause minor or major complications and the accuracy of tissue sampling by needle biopsy tends to be impacted by the quality of the tissue samples obtained. A large number of studies have described the application of TE in diagnosing different types of liver disease.

Chronic hepatitis C

By now, the efficacy of TE in chronic hepatitis C has been most extensively established. To assess the severity of liver fibrosis (F0–F4; 0: no fibrosis, 1: mild fibrosis, 2: moderate fibrosis, 3: severe fibrosis, 4: liver cirrhosis), liver fibrosis stages have been defined as $\geq$F2 (if $E > 7.1$ kPa), $\geq$ F3 (if $E > 9.5$ kPa), and F4 (if $E > 12.5$ to 14.6 kPa).

Chronic hepatitis B

The severity of liver fibrosis has been defined as follows: $\geq$F2 if $E > 7.0$ kPa; $\geq$F3 if $E > 8.4$ kPa; and F4 if $E > 13.4$ kPa.

Other liver diseases

Few studies have chronicled the use of TE in other chronic liver diseases, including alcoholic and nonalcoholic fatty liver disease, autoimmune liver disease, liver failure after transplantation, and special populations (e.g., combined infections of HIV and chronic hepatitis C, dialysis patients with chronic hepatitis C, and acute hepatitis). The definite cut-off value of the E for these conditions requires further confirmation by research.

Conflicts of interest: The author declares no conflicts of interest.

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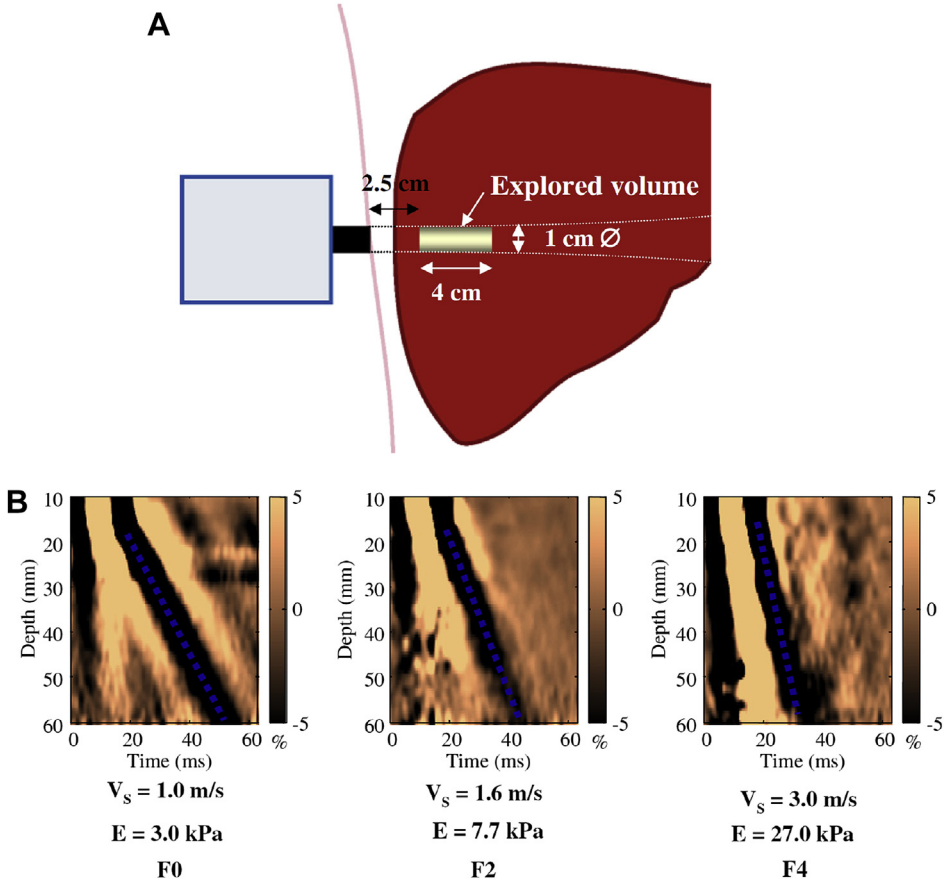

Fig. 1 The principle of transient elastography.

Evaluation of hepatic venous pressure and gastroesophageal varices

TE has been proven to be positively correlated with the hepatic venous pressure gradient. Furthermore, when E > 13.9—21.3 kPa, the patient is very likely to have been esophageal varices. If E > 19.0—30.5 kPa, the patient is likely to have large gastroesophageal varices, which are prone to bleed easily.

Evaluation of liver cancer

To evaluate chronic hepatitis C-associated liver cancer, research has indicated that compared to patients with E < 10.0 kPa, the risk of liver cancer is 17-, 21-, 26-, and 46-fold greater in patients with E 10.1—15.0 kPa, 15.1—20 kPa, 20.1—25.0 kPa, and > 25.0 kPa, respectively.

Limitations and prospects of TE

Although TE is a convenient, noninvasive diagnostic tool, many limitations are still associated with this technique. For obese patients (body mass index > 30 kg/m^2), children, or patients with a narrow intercostal space, the standard M probe may not be able to measure the E or the fluctuations in measures due to the instability of the elastic shear wave propagating through the tissue. Operators can now use probes in sizes XL (for a scanned area 35—75 mm underneath the skin surface) and S (for a scanned area 15—50 mm underneath the skin surface). In addition, the instability of energy transmission led by the propagation of the elastic shear wave through the water layer and the increased hardness of the liver can result in high E. In patients with ascites, acute hepatitis, and obstructive liver disease who have hepatic inflammatory edema, the severity of liver fibrosis can be overestimated. For patients with stable liver disease who receive routine drug treatment, early research has shown the E decreased in long-term sequential testing. Nonetheless, the value of TE to diagnose fibrosis evolution via sequential liver biopsies has not been confirmed. In summary, TE is a simple-to-operate, stable, and noninvasive examination tool that can be used to detect the severity of liver fibrosis, evaluate liver cirrhosis-related complications and assess the incidence of liver cancer. At present, TE can increase diagnostic accuracy if probes appropriate to the patient's body sizes are used. More attempts to compensate for the adequacies of this modality will be needed.